CODE APPLICATION NOTICE

FILE NO. 2-1648B
DATE: April 7, 2000

NOTE: This CAN applies only to retrofit projects received by the Office prior to November 2, 2002. On November 2, 2002, the 2001 edition of the California Building Standards Code (CBSC) became effective. The 2001 CBSC clarifies and expands the requirements for seismic design. Therefore, this CAN is not applicable to projects submitted on or after that date.

CODE SECTION: 1648B, DIV III-R, Chapter 16B, Part 2, 1998 California Building Code

~~**SEISMIC RETROFIT OF STRUCTURE FROM SPC-1 TO SPC-2**~~

1648B-Method B

1648B.1 The existing or retrofitted structure shall be demonstrated to have the capability to sustain the deformation response due to the specified earthquake ground motions. The engineer shall provide an evaluation of the response of the existing structure in its current configuration and condition to the ground motions specified. If the building's seismic performance is evaluated as satisfactory and the peer reviewer(s) [OSHPD 1: and the enforcement agent] concurs, then no further engineering work is required. When the evaluation indicates the building does not meet the objective of the Division III-R safety goals [OSHPD 1: and the applicable structural seismic performance (SPC) and nonstructural seismic performance (NPC) requirements,] then a retrofit and/or repair design shall be prepared that yields a structure that meets the life-safety [OSHPD 1: and operational] performance objectives of Section 1640A of Division III-R and reflects the appropriate consideration of existing conditions. Any approach to analysis and design may be used that yields a building of reliable stability in the prescribed design earthquake loads and conditions. The approach shall be rational, shall be consistent with the established principals of mechanics, and shall use the known performance characteristics of materials and assemblages under reversing loads typical of severe earthquake ground motions.

Exception: *Further consideration of the structure's seismic performance can be waived by the Enforcement Agent if both the engineer-of-record and peer reviewer(s) [OSHPD 1: and/or Enforcement Agent] conclude that the structural system can be expected to perform at least as well as required by Division III-R provisions without completing an analysis of the structure's conformance to these requirements. A detailed report shall be submitted to the responsible Enforcement Agent that presents the reasons and basis for this conclusion. This report shall be prepared by the engineer of record. The peer reviewer(s) [OSHPD 1: and/or Enforcement Agent] shall concur in this conclusion and affirm to it in writing*

PURPOSE:

The purpose of this CAN is to provide an acceptable approach for seismic retrofit of a structure from an SPC 1 level to an SPC 2 level only by modifying the building such that it will pass the detailed evaluation procedures without any unmitigated "False" responses to the evaluation

statements. This methodology does not apply to hospital buildings utilizing "Building Type 8-Concrete Moment Frame" as specified in Section 2.2.3, Article 2, Chapter 6, Part 1, Title 24.

INTERPRETATION:

Analysis and retrofit of existing structures for earthquake loading is complex. Many different approaches to linear and non-linear static, pseudo-dynamic and dynamic analytical procedures have been developed and used in particular cases. However, while there is no consensus on a single acceptable analytical procedure for all circumstances, in general, older buildings with certain attributes have performed adequately in past earthquakes. The Title 24 requirements (Chapter 6, Part 1) for the seismic evaluation of existing hospital buildings identify structures with these desirable attributes. By definition, a building that meets the requirements of SPC-2 outlined in the evaluation procedures meets the requirements for basic life safety. Therefore an acceptable approach for seismic retrofit of a structure from SPC-1 to SPC-2 would be to modify the building, such that it will pass the evaluation procedure without any unmitigated "False" responses to the evaluation statements.

Care must be taken when this approach to retrofit is followed. The evaluation procedures contain many statements that can be classified as "triggers". These include the "quick check" procedures, and evaluation statements that focus on aspect ratios of structural elements (for example, statements covering overturning and boundary elements in concrete shear walls). Evaluation statements of this nature trigger a detailed analysis of the structure, or may automatically place a building in SPC-1 category. An effective seismic retrofit strategy not only focuses on the evaluation statements, but also includes a full analysis of the structure, to ensure that a complete load path, of sufficient strength, ductility, and stiffness is present.

The evaluation procedure shall be used to identify the principal weaknesses of the structure. Existing structural elements shall be reinforced, and/or new structural elements added, to eliminate or mitigate "False" responses to the evaluation statements. All existing and new or modified elements shall be capable of resisting the design forces and displacement requirements specified in the seismic evaluation procedure, Article 2, Chapter 6, Part 1, Title 24. The detailing of new structural elements shall meet the requirements of the 1998 CBC. Detailing of modified or reinforced structural elements shall meet the provisions of the 1998 CBC. Alternatively the detailing may be substantiated by full scale cyclic testing or by advanced analytical techniques to meet the ductility demand of 4.0 as specified in FEMA 273, Table 6-5 and applies to all types of Lateral Force Resisting systems for the purpose of these regulations.

A detailed analysis of the building shall be performed. Where evaluation statements refer to the "quick check" procedure of Section 2.4.7, Article 2, Chapter 6, Part 1, Title 24, a detailed analysis of the building, including determination of element shear and flexural demands and capacities shall be performed. Where "quick checks" for story drift are required, a detailed three-dimensional analysis of the building will be performed to obtain the story drifts. Allowable story drift is specified in Section 2.4.4, Article 2, Chapter 6, Part 1, Title 24.

REASON:

The retrofit design methodology outlined in Figure 1 provides a simplified approach for strengthening buildings to the SPC-2 performance level. The methodology is most suitable for structures with clearly defined deficiencies. Buildings with systemic problems, for example, nonductile concrete frames or URM bearing wall structures, will not benefit from the application of the simplified technique. Structures with systemic deficiencies require the addition of a new, essentially complete lateral force resisting system of sufficient strength and ductility. Division IIIR, Method A, or the advanced analytical techniques available under Method B will generate more efficient and cost effective strengthening solutions for these buildings.

ORIGINAL SIGNED	9/17/04
Kurt A. Schaefer	Date

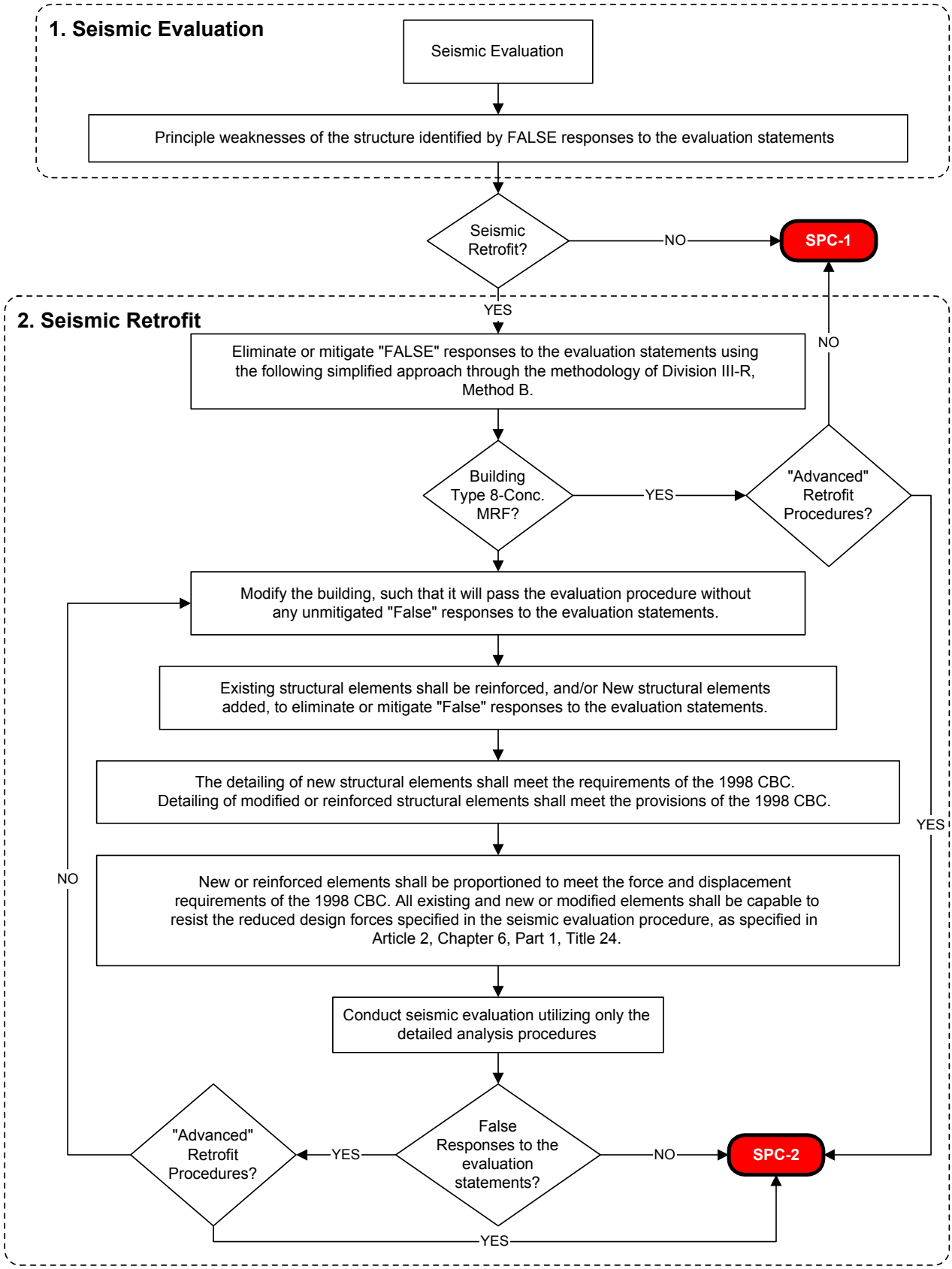

Figure 1 An Acceptable approach to retrofit a Hospital Building from an SPC 1 Level to an SPC 2